Paper No. 42

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte TADAKUNI NARABU,
MAKI SATO, and YASUHITO MAKI

Appeal No. 1998-3135
Application No. 08/789,519[1]

HEARD: MARCH 6, 2001

Before THOMAS, BARRETT, and LEVY, Administrative Patent Judges.

LEVY, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 5 and 6[2].

[1] Continuation of 08/566,476, filed December 4, 1995; which is a continuation of 08/323,052, filed October 12, 1994; which is a continuation of 08/026,017, filed March 4, 1993, all abandoned.

[2] Claims 1-4, 7, and 8 have been cancelled. Claim 9 remains withdrawn from consideration based upon a restriction requirement (Paper No. 34, mailed August 13, 1997).

BACKGROUND

The appellants' invention relates to a charge-to-voltage converter having an adjustable conversion factor. An understanding of the invention can be derived from a reading of exemplary claim 5, which is reproduced as follows:

5. A charge-to-voltage converter of a floating diffusion output type for producing a signal voltage by injecting signal charge packets transferred from a charge transfer region into a floating diffusion region via an output gate, said converter comprising:

a precharge drain region supplied with a reset voltage;

a floating diffusion region; said floating diffusion region being separated from said precharge drain region by a first channel region and a second channel region, with said second channel region being isolated from said floating diffusion region by said first channel region;

a first precharge gate electrode formed over said first channel region;

a second precharge gate electrode formed over said second channel region;

the charge-to-voltage conversion factor being selectively changed in response to gate voltages selectively applied to said first and second precharge gate electrodes; and

said floating diffusion region being connected only to said output gate, said first precharge gate and an output terminal.

The prior art references of record relied upon by the examiner in rejecting the appealed claims are:

Itoh et al. (Itoh)	4,993,053	Feb. 12, 1991
Kadota (Japanese Patent[3])	56-036162	Apr. 9, 1981

Claim 5 stands rejected under 35 U.S.C. § 103 as being unpatentable over Kadota. Claim 6 stands rejected under 35 U.S.C. § 103 as unpatentable over Itoh.

Rather than reiterate the conflicting viewpoints advanced by the examiner and the appellants regarding the above-noted rejections, we make reference to the examiner's answer (Paper No. 38, mailed July 1, 1998) for the examiner's reasoning in support of the rejections, and to the appellants' brief (Paper No. 37, filed June 15, 1998) for the appellants' arguments thereagainst. Only those arguments actually made by the appellants have been considered in this decision. Arguments

[3] In determining the teachings of Kadota, we will rely on the translation provided by the USPTO. A copy of the translation is attached for the appellants' convenience.

which the appellants could have made but chose not to make in the briefs have not been considered. See 37 CFR 1.192(a).

OPINION

In reaching our decision in this appeal, we have carefully considered the subject matter on appeal, the rejections advanced by the examiner, and the evidence of obviousness relied upon by the examiner as support for the rejections. We have, likewise, reviewed and taken into consideration, in reaching our decision, the appellants' arguments set forth in the brief along with the examiner's rationale in support of the rejections and arguments in rebuttal set forth in the examiner's answer.

It is our view, after consideration of the record before us, that the evidence relied upon and the level of skill in the particular art would have suggested to one of ordinary skill in the art the invention as set forth in claim 5. It is our further view that the evidence relied upon and the level of skill in the particular art would not have suggested to one

of ordinary skill in the art the invention as set forth in claim 6. Accordingly, we affirm-in-part.

In rejecting claims under 35 U.S.C. § 103, it is incumbent upon the examiner to establish a factual basis to support the legal conclusion of obviousness. See In re Fine, 837 F.2d 1071, 1073, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). In so doing, the examiner is expected to make the factual determinations set forth in Graham v. John Deere Co., 383 U.S. 1, 17, 148 USPQ 459, 467
(1966), and to provide a reason why one having ordinary skill in the pertinent art would have been led to modify the prior art or
to combine prior art references to arrive at the claimed invention. Such reason must stem from some teaching, suggestion or implication in the prior art as a whole or knowledge generally available to one having ordinary skill in the art. Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 1051, 5 USPQ2d 1434, 1438 (Fed. Cir.), cert. denied, 488 U.S. 825 (1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 293, 227 USPQ 657, 664 (Fed. Cir. 1985), cert. denied, 475 U.S. 1017 (1986); ACS Hosp. Sys., Inc. v.

Montefiore Hosp., 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984). These showings by the examiner are an essential part of complying with the burden of presenting a prima facie case of obviousness. Note In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). If that burden is met, the burden then shifts to the applicants to overcome the prima facie case with argument and/or evidence. Obviousness is then determined on the basis of the evidence as a whole. See id.; In re Hedges, 783 F.2d 1038, 1039, 228 USPQ 685, 686 (Fed. Cir. 1986); In re Piasecki, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984); and In re Rinehart, 531 F.2d 1048, 1052, 189 USPQ 143, 147 (CCPA 1976).

We consider first the rejection of claim 5 based on the teachings of Kadota. The claim language at issue recites that "the charge-to-voltage conversion factor being selectively changed in response to gate voltages selectively applied to said first and second precharge gate electrodes." The examiner's position (answer, page 4) is that "[i]t would have been obvious to one of ordinary skill in the art that the gate voltages are selectively applied to the first and second

precharge gate electrodes; therefore, the charge-to-voltage conversion factor of the device in Kadota is selectively changed." The appellants assert (brief, page 4) that the examiner has made an unsupported allegation that the reference renders obvious appellants' claimed adjustment of the charge-to-voltage conversion factor of the device. Specifically, the appellants assert (id.) that "the Kadota reference is merely directed to resetting the diffusion region. It does not disclose or suggest adjustment of the dynamic range as claimed in the present invention." The examiner responds (answer, page 6) by asserting that "[t]here is no 'adjustment of the dynamic range' in claim 5 as argued by Appellants in the end of page 4."

We note that claim 5 sets forth selectively changing the charge-to-voltage conversion factor. We find that Kadota is directed to an electric charge transferring device. Kadota (translation, page 4) discloses that the voltage of power source 7 of the charge transferring element is normally 10-20V. In some instances, the voltage of the power source 7 has to be lowered, resulting in a "greatly reduced" final

output voltage amplitude VA, as shown in Figure 2. The purpose of the invention,
according to Kadota, (translation, page 5) is to provide an electric charge transferring element which provides a sufficient output voltage even when the power source voltage is low. Figure 3 of Kadota shows a working example of the invention, in which a second diffusion layer 12, a second precharge gate electrode (gate) 13 with accompanying terminal 14, and a terminal 15, are provided. Kadota discloses (id.) that "[t]he floating capacities of the high electric conductivity impurity diffusion layers (2, 12) are described as 'C_{f1}' and 'C_{f2}', respectively." Kadota additionally discloses (translation, page 6) that the first precharge gate (reset gate) 5 turns on before the next signal electric charge is transferred, connecting the diffusion layers 2 and 12. Figures 4 (D) and (E) (translation, page 6) show the changes in the diffusion layers 2 and 12 "when the pulse voltages shown in Figs. 4 (A), (B) and (C) are impressed on the terminals (9, 15, 14)." As a result of these pulse voltages (translation, page 7) "the signal electric charge stored in the . . . diffusion layer (2) is equivalently reset with a

higher voltage than the outside power source voltage." Kadota likewise asserts (translation, page 9), with regard to the embodiment shown in

Figure 5, that "the electric charge of the first . . . diffusion layer can be reset with a high voltage even when the power source voltage is low, and a sufficient output voltage can be obtained." From the above teachings of Kadota, we find that the voltage of the first diffusion region 2 can be reset with a high voltage. This begs the question of whether the resetting of the voltage of the diffusion layer changes the charge-to-voltage conversion factor. On page 3 of the appellants' specification, in a description of the prior art, the specification discloses

> in the conventional charge-to-voltage converter of a floating diffusion output type and a floating gate output type mentioned above, the capacitance of the converter is of a fixed value. It is, therefore, impossible to selectively change the charge-to-voltage conversion factor of the converter, and the convertion factor is determined merely as a single value as follows.
>
> With regard to the signal charge quantity Q, the signal amplitude V in the FD region 1 (in FIGURE 5) and 11 (in FIGURE 6) is expressed as
>
> V = Q/C = Ne-/C .... (1)
>
> where N is the number of electrons; e- denotes an elemental charge (- 1.6x 10-19[C]); and C is the capacitance of the FD region 1 (in FIGURE 5) and 11

> (in FIGURE 6).
> Therefore the conversion factor 0H, i.e., the signal amplitude obtained at the time of input of one electron to the FD region 1 (in FIGURE 5) and 11 (in FIGURE 6), is given by
> 0H = V/N = e-/C .... (2)

We find from equation 1 (V = Q/C = Ne-/C) that the signal amplitude V is directly related to the capacitance of the electric charge converter. In addition, it is clear from equation 2 (0H = V/N = e-/C) that the conversion factor 0H is directly related to the signal amplitude V. In view of Kadota's addition of a second gate and second diffusion region, and the changing the voltage of the floating diffusion region 2, we find that in Kadota, the charge-to-voltage conversion factor is selectively changed by resetting the diffusion layer to a high voltage. Thus, we conclude that Kadota meets the recited claim language of the conversion factor being selectively changed in response to gate voltages selectively applied to said first and second precharge gate electrodes. Accordingly, we will affirm the rejection of claim 5 under 35 U.S.C. § 103.

Turning next to the rejection of claim 6 under 35 U.S.C.

§ 103, the sole issue, as indirectly advanced in the brief, and further expounded upon by appellants' counsel during the oral hearing, is whether the clause "wherein said floating diffusion region is connected only to the output gate, said first precharge gate and an output terminal" (underlining added). The appellants assert (brief, page 5) that Itoh "employs a much different structure for accomplishing adjustment." The appellants further assert (brief, page 6) that "[t]he connection of three gates to the floating diffusion region instead of two gates increase the effective capacitance and prevents the arrangement from attaining the highest possible sensitivity. . . . Although the examiner has asserted that the elimination of elements would have been obvious, applicants have shown that improved results can be achieved by eliminating certain structures." The examiner's position (answer, pages 4 and 5) is that "[o]nly diffusion region 203 is directly adjacent to the floating diffusion 205 [sic: 202]."

We note at the outset that the claim term "only" defines a structural limitation that must be considered when interpreting the claim. In the appellants' invention

disclosed in Figure 2(a), the floating diffusion region 1 only connects with the output gate OG, the precharge gate PG and the output terminal SIGNAL VOLTAGE. When adding the additional diffusion regions and gates to the prior art invention found in prior art Figure 5(a), the additional gates and diffusion regions were added in a linear fashion, i.e., in a straight line along the axis of the charge transfer section. In Itoh, the prior art embodiment shown in Figure 1(a) also discloses that the floating diffusion area 401 to be connected only to the output gate 8, first precharge gate 403, and to the output terminal.

However, in the embodiments of Itoh that include the additional gates and diffusion regions, the additional gates and diffusion regions are turned 90 degrees from the axis of the charge transfer section 3, as in the embodiments shown in Figures 4(a) and 5(a). In the embodiment of Figure 6(a) of Itoh, additional gates and diffusion regions are shown as both rotated 90 degrees from the axis of the charge transfer section, and coaxial with the charge transfer section. We therefore find that none of the embodiments 4(a), 5(a), and 6(a) of Itoh show a floating diffusion region that is only

connected to the output gate, first precharge gate and the output terminal. In Figure 4(a) of Itoh, the floating diffusion region is additionally connected to reset gate electrode 105, having terminal i_R. Similarly, in the embodiment of Figure 5(a) of Itoh, the floating diffusion region is additionally connected to reset gate electrode 105, having terminal i_R. Moreover, in the embodiment of Figure 6(a) of Itoh, the floating diffusion region is additionally connected to both reset gate electrode 307, having terminal i_R, and to second gate electrode 310, having terminal SEL 3.

We find no teaching in Itoh, nor has any persuasive reason been advanced by the examiner, to suggest modifying Itoh to connect the floating diffusion region only to the output gate, first precharge gate and the output terminal, as claimed. We therefore conclude that the examiner has failed to establish a prima facie case of obviousness with respect to claim 6. Accordingly, the rejection of claim 6 under 35 U.S.C. § 103 is reversed.

CONCLUSION

To summarize, the decision of the examiner to reject claim 5 under 35 U.S.C. § 103 is affirmed. The decision of the examiner to reject claim 6 under 35 U.S.C. § 103 is reversed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136 (a).

AFFIRMED-IN-PART

JAMES D. THOMAS Administrative Patent Judge	)	
LEE E. BARRETT Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
STUART S. LEVY Administrative Patent Judge	)	

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